MST e-NEWS

March 2011

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Tome accomplishments honored at symposium

The contributions of Carlos Tome (Structure/Property Relations, MST-8), to the field of mechanical behavior of polycrystalline materials were recently recognized at a symposium of the 2011 TMS (The Minerals, Metals and Materials Society) Annual Meeting in San Diego, Calif.

"Polycrystal Modelling with Experimental Integration: A Symposium Honoring Carlos Tome," featured current theoretical, computational, and experimental issues related to microstructure-property relationships in polycrystalline materials deforming in different regimes (elastic, elastoplastic, viscoplastic), including the effects of single crystal ani sotropy, texture, and microstructure evolution.

Organized by Ricardo Lebensohn (MST-8), Sean Agnew (University of Virginia) and Mark Daymond (Queen's University), the symposium included more than 90 presentations, including a keynote by Tome and 35 invited lectures.

Tome and collaborators developed polycrystal modeling techniques and numerical codes that are widely used in the materials science and engineering community, as predictive tools for parameter identification, interpretation of experiments, and multiscale calculations. He has coauthored two books, *Texture and Anisotropy* in 1998 and *Fundamentals and Engineering of Severe Plastic Deformation* in 2010, published 110 peer-review articles, and has contributed four times to the materials science sections of the yearly *American Society of Metals Handbook*. The *Journal of Metals* profiled Tome in its October 2010 issue.

Tome, who has a PhD in physics from the National University of La Plata, Argentina, joined the Laboratory in 1996 and is the MST-8 materials modeling team leader.

Fuel Cycle Research and Development milestones achieved

Laboratory researchers successfully met three Fuel Cycle Research and Development (FCR&D) program milestones during the past few months. These milestones included new equipment installation, capability development, and data collection and analysis.

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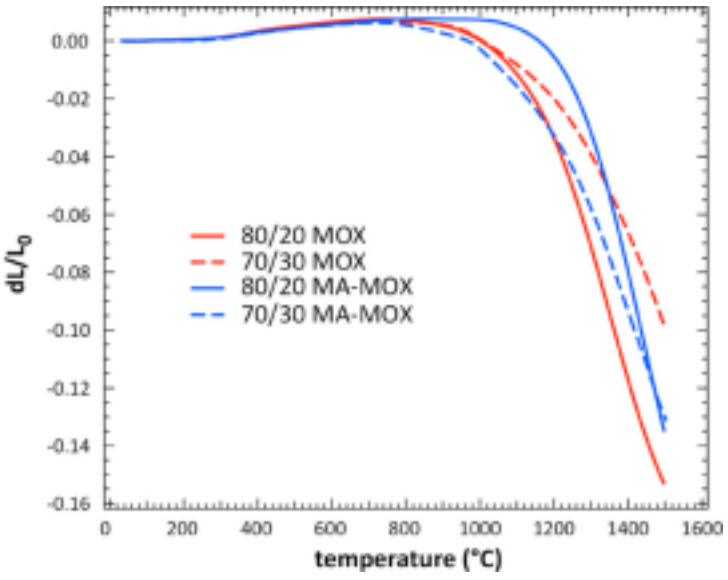
Fuel Cycle . . . The first of these milestones was the purchase and installation of a new high-temperature oxide-melt calorimeter. This instrument, the first commercial version of its type in the United States, was designed and built by SETARAM Instruments under the guidance of Professor Alexandra Navrotsky (University of California, Davis). This system re-establishes a capability at Los Alamos that was lost when Wing 2 of the CMR Building was closed in 2007. The calorimeter, which is located in the Target Fabrication Facility, will be used to evaluate the suitability of proposed nuclear waste form materials by measuring their thermodynamic properties. The technical points of contact are Jeremy Mitchell (Nuclear Materials Science, MST-16) and Hongwu Xu (Earth Systems Observations, EES-14), and the lead operator is Manuel Chavez (MST-16).

Great strides have been made in the past few months to measure the thermodynamic properties of ceramic nuclear fuels in PF-4, TA-55. In collaboration with MST-8 and Actinide Process Support (MET-1), MST-16 applied its differential scanning calorimetry and dilatometry systems to measure the heat capacity, thermal expansion, and sintering behavior of mixed-oxide (UO_2-PuO_2) and minor actinide (MA)–bearing MOX (MOX with NpO_2 and AmO_2) fuel pellets. The data are needed to understand the behavior of these materials during processing, to optimize processing parameters, and to provide critical nuclear reactor fuel performance information.

Jeremy Mitchell and Dan Schwartz are the MST-16 technical points of contact. James Gallegos, Mike Ramos, and Manuel Chavez (MST-16) provided critical assistance in meeting the milestone.

Collaboration between MST-16, Inorganic, Isotope and Actinide Chemistry (C-IIAC), and MST-8 for the core materials mechanical testing program resulted in a draft report on coordination of experiments with modeling and simulation program needs. Scientists completed a series of strain rate jump tests on irradiated HT-9 ferritic-martensitic steels. These experiments play an important role in measuring strain rate sensitivity and validating models of mechanical behavior of irradiated materials. Researchers combined the initial data with modeling input to generate a plan for future experiments in accordance with the FCR&D separate effects test plan. Stuart Maloy is the Advanced Nuclear Energy Program Manager for this work, which the DOE Office of Nuclear Energy funds. The work supports the Lab's Energy Security mission area and the Materials of the Future capability pillar. Toby Romero (C-IIAC) performed the mechanical testing at the CMR hot cells.

Technical contacts: Tarik Saleh (MST-16, experimental) and Ricardo Lebensohn (MST-8, modeling)



In situ sintering results of MOX and MAMOX fuel pellets from the TA-55 dilatometer. The pronounced sample shrinkage records the onset and progression of sintering.

Preparation of a dense, polycrystalline ceramic structure patented

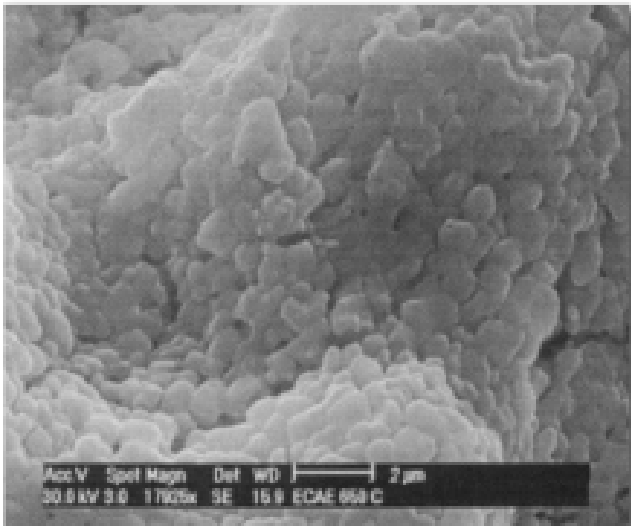
Materials Technology-Metallurgy (MST-6) scientists received a patent for a novel process to produce dense polycrystalline ceramic structures from ceramic powders. Such structures can exhibit superior properties compared with their coarser polycrystalline counterparts. These properties make them appealing for optical, microelectronic, magnetic, structural, thermal, electric, chemical, and refractory applications.

Nanocrystalline ceramic structures may be formed by sintering ceramic nanopowder, which typically involves heating ceramic powder to a temperature below the melting point, sometimes under pressure. The final sintered structure is polycrystalline. All conventional sintering methods cause some grain growth that can result in grains much larger than those of the starting nanopowder.

Jason Cooley, Chris Chen, and David Alexander (MST-6) developed a technique that requires sealing ceramic powder inside a metal container under a vacuum. They force the container through a severe deformation channel at an elevated temperature that is below the melting point of the ceramic nanopowder. When the ceramic powder inside the container is ceramic nanopowder, the dense polycrystalline structure formed inside the container is a dense, nanocrystalline ceramic structure.

Reference: "Preparation of a Dense Polycrystalline Ceramic Structure," US Patent No. 7,846,378 B2, December 7, 2010. The Department of Homeland Security's Domestic Nuclear Detection Office funded the research. The work supports LANL's Global Security mission area and the Materials of the Future capability pillar.

Technical contacts: Jason Cooley, Chris Chen or David Alexander



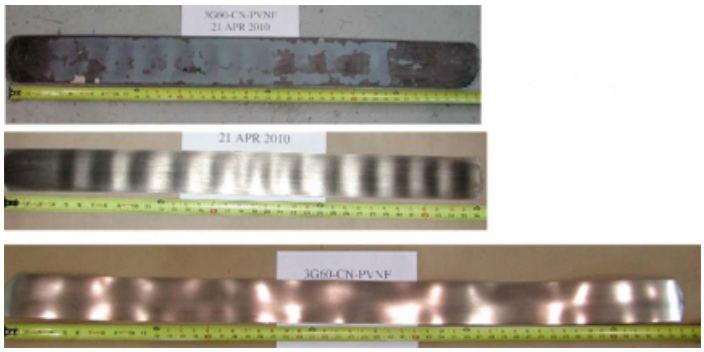
Scanning electron micrograph of the nanocrystalline ceramic structure.

LANL-made low enriched uranium foils selected for irradiation test

Six low enriched uranium (LEU) uranium-10 weight% molybdenum (Mo) foils made by Los Alamos were selected for an irradiation test that is on the critical path for qualification of LEU monolithic fuel. Fuel qualification is key to the success of the DOE NA-21 Convert program. The program will convert research reactors around the world from the use of highly enriched uranium (HEU) to low enriched uranium.

These efforts will enable permanent threat reduction by minimizing, and to the extent possible, eliminating the need for HEU in civilian applications. Each nuclear reactor converted or shut down eliminates a source of bomb material. The Convert Program is part of President Obama's comprehensive strategy to prevent nuclear terrorism. The program has been featured at the 2010 Security Summit in Washington, D.C., and in the Nuclear Posture Review.

The Los Alamos foils were selected for their high quality and the outstanding characterization data that accompanied them. They will be used in the AFIP-7 irradiation test in the Advanced Test Reactor at Idaho National Laboratory. This will be the first time that full sized, mechanically constrained, LEU fuel foils (39 inches long) are tested. Part of the Los Alamos accomplishment was making high quality foils from extremely high carbon content cast U-10 wt% Mo ingots. No other participating organization could process this difficult material with anything approaching such high (100%) yield, and one organization only achieved 12% yield. The technically deep and long-term uranium processing expertise at the Laboratory made this achievement possible.



LANL-rolled LEU foils that met Idaho National Laboratory's requirements. From top: 3G60-CN-PVNF, 21 APR 2010; 21 APR 21010 and 3G60-CN-PVNF

The LEU foils were the result of a team effort spanning multiple organizations and functions. Teams in uranium characterization, criticality, safety basis, shipping, and radiography supported the processing team members, who performed cleaning, machining, welding, and co-rolling. The scientists processed the material in the LANL Sigma Complex, which has been processing uranium metals and compounds at lab scale and plant scale for 50 years. Although depleted uranium, LEU, and HEU have been processed in the Sigma Complex previously, safety basis guidelines have changed significantly since the last time LEU was processed in these quantities. Paul Dunn, Dave Teter, Maria Pena, and Lydia Apodaca (MST-6); Gail Johnson, Terry Morrison, Rich Norman, Tony Marth, and Andrea Pistone (Science and Technology Operations, STO-FOD); Shean Monahan and Doug Bowen (Safety Basis-Criticality Safety, SB-CS); John Breiner (Industrial Hygiene and Safety-Deployed Services, IHS-DS); and Mack Mackenzie (Radiation Protection Operations, RP-1) contributed to the activities.

The successful preparation of the foils presented many technical challenges. The cast LEU U-10 wt% Mo ingots were simultaneously coated with zirconium and made into foil using a process called co-rolling. Material that is co-rolled can have many different constraints on it that are not present in conventional rolling. For example, the mechanical behavior of the three principal co-rolling constituents is significantly different at the 650 ºC co-rolling temperature. In addition, the feedstock material from the NNSA Y-12 plant contained carbon above the solid solubility limit. This resulted in non-uniform scattering of carbide precipitates throughout the material. Despite these difficulties, the team obtained six 0.015-inch thick zirconium coated foils from six 0.125-inch thick cast ingots that met Idaho National Laboratory's specifications for thickness. Uniform thickness is important for avoiding hot spots during irradiation. he technical leadership of Duncan Hammon was critical to successful rolling this high inclusion content, heterogeneous material into thin foil.

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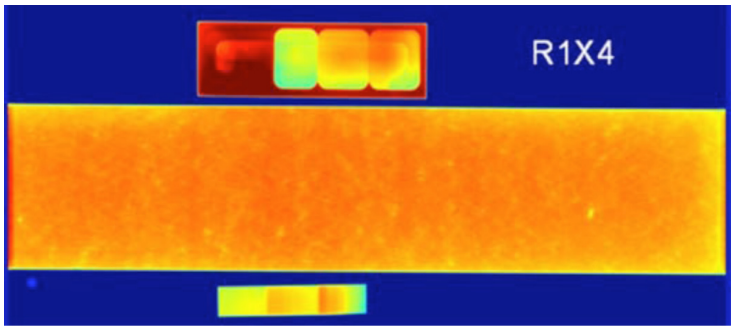
Foils . . . Joel Katz (MST-6) coordinated the processing, which included Randy Edwards, Karen Rau, Andy Duffield, Duncan Hammon, Pat Kennedy, Victor Vargas, Kester Clarke, and Dave Alexander (MST-6). Amy Clarke, Ann Kelly, Pallas Papin, Jim Foley, and Bob Forsyth (MST-6) characterized phase distribution, grain size, inclusion chemical composition, and interface quality. Tom Claytor (Non-Destructive Testing and Evaluation, AET-6), Heather Volz (MST-6), George Havrilla and Velma Montoya (Chemical Diagnostics and Engineering, C-CDE) developed additional characterization techniques of radiography and measurement of macrosegregation of molybdenum content in the as received cast material.

Dave Dombrowski (MST-6) is the Los Alamos program manager for Convert Fuel Fabrication, a Non-Proliferation program in Global Security. The Global Security contact is Noah Pope (GS-NN), Deputy director for Nuclear Non-Proliferation Programs in Global Security. The work supports the Lab's Global Security and Energy Security mission areas, and the Materials for the Future capability pillar.



Digital radiography of the second set of Los Alamos co-rolled foils. There were no regions of high density seen in any of the foils. The foil has a very uniform thickness with a subtle waviness about 4% with a wavelength of 112 mm.

Teaming up to provide solutions

Want to help your co-workers find answers to safety and security issues that leave them frustrated and unable to get their work done efficiently? Consider volunteering to serve on your group's Solutions Team.

Begun this year, the three-member teams, composed of an R&D staff member, one Worker Safety and Security Team (WSST) member and a technician or research technologist, perform peer-to-peer walkarounds of work areas with the intent of finding and fixing vulnerabilities on the spot.

"You're doing your coworkers a favor by pointing out potentially hazardous situations, helping them get the resources they need, and documenting trends you're not even aware of," said Eve Bauer of the Materials Chemistry (MPA-MC) Solutions Team and chair of the Materials Physics and Applications WSST.

"Solutions Teams look out for our colleagues by helping them get the resources they need to do their work in a safe and secure manner."
Associate Director Experimental Sciences
Susan J. Seestrom

Housekeeping, waste reduction, and electrical issues are some of the more common challenges taken up by the teams, Bauer said. "In one of our walkarounds we noticed an exposed wire in an 110 outlet and we were able to get that fixed right away. It didn't get lost in the system," she said. The electrical safety officer was called in to check the space and offered safe alternatives to the "daisy chaining" (plugging into each other) extension cords.

Teams are required to document their findings and present an informational summary at the end of their term to the ADEPS Council that captures the overall evaluation of the safety culture and identifies problem areas and deficiencies.

Team members serve for about three months and participation generally requires about an hour and half of a person's time. "You can get as involved as you want," Bauer said.

To volunteer for a Solutions Team, to schedule a walkaround, or for more information, contact one of your group's WSST members.

Your WSST members

MST: Erik Luther, Dave Alexander, Diana Honell, Stephanie Tornga, Thomas Sisneros, Andy Nelson, Sue Duncan

LANSCE: Jean Trujillo, Nathan Okamoto, Hank Alvestad, Phil Chacon, Fermin Gonzales, Dominic Tafoya, Victor Vigil, Vince Melito, Thomas Spickermann, William Roybal, John Lyles, Howard Nekimken, Eric Larson, John Ullmann, Leo Bitteker, Dan Seely, Carl Morgan, John Graham, Kristy Ortega , John Erickson (champion), Kurt Schoenberg (champion)

MPA: Eve Bauer, Mike Torrez, Paul Mombourquette, John Rowley, Lisa Phipps

P: Jeff Bacon, June Garcia, Larry Rodriguez, Robert Aragonez, George Sandoval, Todd Womack

HeadsUP!

Frog stop

MST-6 Group Leader Paul Dunn was recently summoned to take a look at a strange package that had been delivered. “You have to see this,” the individual exclaimed. “Frogs!” Sure enough the package was full of jumping, croaking frogs. The package was properly marked–frogs–with appropriate breathing holes. This package, which was mistakenly delivered to MST-6, did make it to the rightful owner.

All deliveries destined for LANL are required to go though SM-30 unless an exception has been granted. SM-30 personnel are trained for suspicious package identification and package security requirements for SM-30 are driven by SS-1 direction given to ASM-MM. Please be assured packages are screened!

SHIPPING LABELING

LANL frequently ships and receives actinide-containing samples. Last year scientists began doing particle analysis with micro-focused beam, which resulted in some samples that consisted of a 1-2 cm^2 smear of soil across Kapton film, which might only contain a few or even just one uranium or plutonium particle that is only <20 microns in size and may be a deposit on the surface of a mineral grain. The quantities are negligible, often being at or below the threshold for detection. Samples therefore are also DOT exempt, i.e., and could be dropped in a mailbox. Nevertheless, LANL ships them as type A quantities of radioactive material.

After a recent set of these type of experiments, and ignoring LANL’s request that the samples be returned the same way, samples were shipped to LANL without notification in an unlabelled container directly to a scientist’s mail stop instead of to LANL at TA-48 where they had originated.

The limited quantity was technically not a reportable incident; however, the delivery site was not equipped nor authorized to handle plutonium and it did cause some consternation.

Last year a different mistake was made, wherein two shipments were mixed up, sending (fortunately) exempt Hanford plutonium samples to LANL and LANL’s uranium samples to a different lab. Similar shipping errors have also been made in the isotope distribution for plutonium.

Labs that do not routinely use and, therefore, do not have the controls in place for handling radioactive materials are not only much more susceptible to these kinds of errors than LANL, but also have different attitudes concerning the amount of care and oversight that needs to go into these procedures.

Meeting planning services available

Got a conference that needs organizing, an event to be planned? Rose Romero, the ADEPS meeting coordinator, can help.

With 15 years of Los Alamos conference planning experience, Romero has assisted staff members in planning conferences both large and small, from locally held meetings with a dozen participants to international conferences for hundreds of attendees. Knowledgeable in the Laboratory’s conference management policies and associated allowable conference costs, she can help in overseeing the details that ensure a smooth, successful event.

Romero can assist with developing and overseeing allocated workshop budgets, obtaining the necessary cost codes for workshop funding, negotiating and overseeing contracted food services, and in planning and executing workshop and conference web sites. Her experience includes arranging for transportation, conference facilities, and accommodation and preparing pre-conference materials such as invitation letters, badges, folders, and participant lists. During the workshop, she can manage the registration desk, help in setting up meeting rooms, and in compiling agenda, abstracts, and related materials into post-conference documents.

“I love the variety and working on things from start to finish,” Romero said. “Meeting planning is like putting together a puzzle. Every piece must fit the puzzle for the puzzle to be successfully complete.”

Romero can be reached by calling 665-7657or emailing rbromero@lanl.gov.

Celebrating Service

Congratulations to the following MST employees celebrating service anniversaries this month:

Charles Davis, MST-16	30 years
Blas Uberuaga, MST-8	10 years

MSTeNEWS

Published monthly by the Experimental Physical Sciences Directorate. To submit news items or for more information, contact Karen Kippen, EPS Communications, at 606-1822, or kkippen@lanl.gov.

LALP-11-005